

Assessment of pediatric patients with negative RT-PCR and CT-based COVID-19 diagnosis referred to ICU

Evaluation of pediatric COVID-19 cases referred to ICU

Bensu Bulut¹, Murat Genç², Medine Akkan Öz¹, Ayşenur Gür³, Ramazan Kocaaslan⁴, Dilek Atik⁵, Ramiz Yazıcı⁶, Hüseyin Mutlu⁷¹ Department of Emergency Medicine, Health Sciences University, Gulhane Training and Research Hospital, Ankara² Department of Emergency Medicine, Ankara Training and Research Hospital, Ankara³ Department of Emergency Medicine, Etimesgut Şehit Sait Ertürk State Hospital, Ankara⁴ Department of Urology, Faculty of Medicine, Kafkas University, Kars⁵ Department of Emergency Medicine, Faculty of Medicine, Karamanoğlu Mehmetbey University, Karaman⁶ Department of Emergency Medicine, Kanuni Sultan Süleyman Training and Research Hospital, İstanbul⁷ Department of Emergency Medicine, Faculty of Medicine, Aksaray University, Aksaray, Türkiye

Abstract

Aim: Despite negative RT-PCR results, some pediatric patients show COVID-19 findings on thoracic CT imaging. This study aimed to evaluate laboratory parameters and clinical characteristics of RT-PCR-negative pediatric patients diagnosed with COVID-19 based on thoracic CT findings and referred to the intensive care unit.

Materials and Methods: This retrospective study included 214 patients under 18 years presenting to the pediatric emergency department between March 15 and June 15, 2020. Patients with two negative RT-PCR tests but COVID-19 suspicion on thoracic CT requiring intensive care were enrolled. Patients were categorized into four age groups (0-2, 3-6, 7-11, 12-18 years) and classified as mild and severe hypoxemic patients. Laboratory parameters, including complete blood count, C-reactive protein, and D-dimer, were analyzed.

Results: Mean ages were 1.3 ± 0.5 , 4.3 ± 1 , 9.4 ± 1.4 , and 14.6 ± 1.6 years for respective age groups, with 57.9% males. Over half of patients in younger age groups were asymptomatic (57.1% in 0-2 years, 58.1% in 3-6 years). Significant differences were found between age groups in white blood cell count, lymphocyte, platelet, and red cell distribution width levels ($p < 0.05$). The 0-2 age group showed higher lymphocyte (5.3 ± 3.7) and platelet (387 ± 202) counts compared to older groups. D-dimer and mean platelet volume levels differed significantly between symptomatic and asymptomatic patients ($p < 0.05$). A moderate negative correlation was found between clinical presentation and D-dimer levels ($r_s: -0.342$, $p < 0.05$).

Discussion: Age-related variations in laboratory parameters suggest different immune responses across pediatric age groups in COVID-19. D-dimer and MPV may serve as potential biomarkers for disease severity assessment in RT-PCR-negative pediatric COVID-19 patients.

Keywords

COVID-19, pediatric, RT-PCR-negative, laboratory parameters, intensive care

DOI: 10.4328/ACAM.22826 Received: 2025-07-26 Accepted: 2025-08-25 Published Online: 2025-08-30 Printed: 2025-09-01 Ann Clin Anal Med 2025;16(9):663-667

Corresponding Author: Ayşenur Gür, Department of Emergency, Etimesgut Şehit Sait Ertürk State Hospital, Ankara, Türkiye.

E-mail: draysenurcakici@gmail.com P: +90 553 775 95 21

Corresponding Author ORCID ID: <https://orcid.org/0000-0002-9521-1120>Other Authors ORCID ID: Bensu Bulut, <https://orcid.org/0000-0002-5629-3143> · Murat Genç, <https://orcid.org/0000-0003-3407-1942>Medine Akkan Öz, <https://orcid.org/0000-0002-6320-9667> · Ramazan Kocaaslan, <https://orcid.org/0000-0003-1944-7059> · Dilek Atik, <https://orcid.org/0000-0002-3270-8711>Ramiz Yazıcı, <https://orcid.org/0000-0001-9210-914X> · Hüseyin Mutlu, <https://orcid.org/0000-0002-1930-3293>

This study was approved by the Ethics Committee of Dr. Abdurrahman Yurtaslan Education and Research Hospital (Date: 2021-01-13, No: 2020/07.727).

Introduction

Coronavirus disease 2019 (COVID-19) is an infectious disease caused by severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) and was first described in December 2019 in the Wuhan province of China [1]. This disease, declared a pandemic by the World Health Organization (WHO) on 11 March 2020, has become a serious public health issue, affecting millions of people worldwide [2]. Although most people, including children, are susceptible to SARS-CoV-2, the progress of the disease is usually milder in the pediatric population than in adults. In an epidemiological study conducted in China, it was reported that more than 90% of COVID-19 cases in children were mild or moderate, hypoxemia was less than in adults, and the rate of developing critical illness was only 0.6% [3]. Definitive diagnosis of COVID-19 is made by identifying the viral RNA of SARS-CoV-2 using real-time reverse transcription polymerase chain reaction (RT-PCR) in nasopharyngeal and oropharyngeal swab samples [4]. However, RT-PCR has its limitations. The sensitivity of the test can be between %60 and %70, and it can provide false negative results, particularly in the early stages of the disease or when the viral load is low [5]. It has been reported that the rate of positive RT-PCR tests changes after hospitalization, and that the false negative rate can be high, particularly in the early stages [6]. This demonstrates that in the presence of clinical doubt, radiologic images play a supportive role in diagnosis. Due to these diagnostic challenges, alternative approaches that can assist in the early diagnosis of COVID-19 are needed. Routine laboratory parameters stand out as an easily accessible, fast-acting, and cost-effective method. In adult patients, lymphopenia, thrombocytopenia, elevated C-reactive protein (CRP), elevated lactate dehydrogenase (LDH), and elevated D-dimer levels have been associated with disease severity and prognosis [7,8]. The role laboratory parameters play in diagnosing COVID-19 in the pediatric population has still not been fully understood. In children, it is difficult to interpret laboratory findings due to developmental characteristics of the immune system, age-related physiological changes, and the differences in response to the disease compared to adults [9]. It has been reported that lymphopenia and elevated CRP levels are less common in pediatric COVID-19 patients than in adults [10]. This highlights the need for developing specific diagnostic algorithms for the pediatric population. The risk factors for developing critical illness in children are not yet fully understood. However, among the 345 confirmed pediatric COVID-19 cases with no missing data on underlying conditions, the most frequently reported underlying conditions were chronic pulmonary disease (11.6%), cardiovascular disease (7.2%), and immunosuppression (2.9%) [11]. Additionally, fever, cough, shortness of breath, and dyspnoea have been the most frequently reported clinical findings, respectively, in the United States and China [11,12]. The challenges faced in diagnosing COVID-19 in children are even more pronounced in patients with a negative RT-PCR test but have clinical and radiological findings suggestive of the disease. In the meta-analysis of Mantovani et al., it has been noted that COVID-19 presents a heterogeneous clinical spectrum in children and adolescents and that diagnostic approaches should take this heterogeneity into account [13]. In this context, the role of laboratory parameters in

assessing disease severity and whether or not these parameters differed according to age groups is of critical importance. The aim of this study is to systematically review the demographic characteristics, clinical findings, laboratory parameters, and complaints upon presentation of pediatric patients referred to the intensive care unit (ICU) from the emergency department (ED) with a preliminary COVID-19 diagnosis based on thoracic computerised tomography (CT) findings, despite a negative RT-PCR test. Our study aims to obtain data that will guide clinicians in the management of pediatric COVID-19 by analyzing the differences in laboratory parameters between age groups and changes in biochemical markers between mild and severe hypoxic patients in this special patient group.

Materials and Methods

Study Design and Participants

This study was performed in the COVID-19 outpatient clinic of the Pediatric Emergency Department (PED) of the Ankara Yenimahalle Training and Research Hospital, between 15 March 2020 and 15 June 2020. Patients under the age of 18, who presented to the Ankara Yenimahalle Training and Research Hospital PED COVID-19 outpatient clinic, had two negative reverse transcription polymerase chain reaction (RT-PCR) tests, had COVID-19 suspicion based on thorax CT findings, and were referred due to the need for intensive care, were included in the study. Demographic data, chronic illnesses, clinical findings, and laboratory findings upon presentation to the PED and patient outcomes were reviewed individually and obtained retrospectively. Clinical findings of patients coming to the PED were defined as fever, dyspnea, sore throat, headache, cough, chest pain, abdominal pain, diarrhea, joint pain, and loss of taste or smell. All patients presenting to the COVID-19 PED of our hospital underwent a detailed physical examination, had their vital signs checked, and routinely had RT-PCR, complete blood count (CBC), biochemical parameters, and posteroanterior (PA) chest x-ray requested. Routine laboratory tests, including CBC parameters, were studied from the first blood sample obtained after presenting to the PED. In routine tests, arterial oxygen pressure (PaO₂) lower than 80 mmHg or arterial oxygen saturation (SaO₂) lower than 94% was evaluated as hypoxemia. Metin girmek için buraya tıklayın veya dokunun.. Patients coming to the PED were divided into two groups: mild hypoxemia if SaO₂ was between 90-93%, and severe hypoxemia if it was below 90% [14]. Patients under the age of 18, presenting to the COVID-19 PED, who had severe illness with fever, dyspnea and/or chest imaging congruent with SARS-CoV-2 pneumonia, or, new or increased need for oxygen and/or ventilation support; and critical illness, including respiratory failure requiring mechanical ventilation, acute respiratory distress syndrome, shock, systemic inflammatory response syndrome, and/or multiple organ failure, are assessed as requiring intensive care and are referred to the ICU. Patients were separated into four different age groups: 0-2 years (infancy), 3-6 years (early childhood), 7-11 years (middle childhood), and 12-18 years (adolescence). Patients under the age of 18, who had a negative RT-PCR test, had a COVID-19 diagnosis based on thoracic computerised tomography (TCT), were referred due to the need for intensive care, and whose data were complete

were included in the study. Patients older than 18 years of age, who had a positive RT-PCR test, had no TCT, were diagnosed with COVID-19 without the need for intensive care, and any missing data from among the researched parameters were excluded from the study. No patient consent was required due to the retrospective design.

Statistical Analysis

All statistical data were analysed using SPSS version 20.0 for Windows. Descriptive statistics were used for the assessment of the patient demographics. Chi-square and Fisher’s exact tests were used to compare the rates of categorical variables. Numerical values of the study data were expressed as mean ± standard deviation and minimum- maximum values. The data obtained from the study conducted within the scope of the clinical research were statistically nonparametric in nature. Depending on whether the variables were categorical (nominal or ordinal) or numerical independent groups, the Kruskal-Wallis H test and Mann-Whitney U test were used in statistical evaluations. Parameters found to be meaningful were planned to be evaluated using Spearman’s correlation test. Results were evaluated at a significance level of p<0.05.

Ethical Approval

This study was approved by the Ethics Committee of Dr. Abdurrahman Yurtaslan Education and Research Hospital (Date: 2021-01-13, No: 2020/07.727).

Results

214 patients from among the 3268 patients under the age of 18 who presented to the COVID-19 outpatient clinic of our Emergency Department between the dates of our study were included in the study. The workflow of this study is shown in Figure 1. Mean age of Group 1 was 1,3±0,5 (n=49), Group 2 was 4,3±1 (n=31), Group 3 was 9,4±1,4 (n=38), and Group 4 was 14,6±1,6 (n=96), and %57,9 (n=124) of patients were male. When patients were reviewed according to age groups, there

were more patients in Group 4, and males were numerically dominant in all groups. There was no statistically significant difference in gender distribution between groups based on age (p>0.05). Review of patients based on clinical findings has revealed that although there is a high number of asymptomatic patients, there was no significant difference between age groups (p>0.05). Demographic data and clinical findings of patients are shown in Table 1. There were significant differences in laboratory parameters between age groups, including white blood cell (WBC), lymphocyte, platelet, and red cell distribution width (RDW) (p<0.05). Although CRP, an acute phase reactant, levels were higher in the 0-2 age group than in other groups

Table 1. Demographic data of patients

Group	0-2 age	3-6 age	7-11 age	12-18 age	p value
Mean Age/Years (mean±SD)	1.3±0.5	4.3±1	9.4±1.4	14.6±1.6	<0.05*
Gender %(n)					0.425
Male	25 (31)	16.9 (21)	16.1 (20)	41.9 (52)	
Female	20.9 (18)	11.1 (10)	20 (18)	48.9 (44)	
Hypoxemia %(n)					0.349
Severe	42.9 (21)	41.9 (13)	52.6 (20)	47.9 (46)	
Mild	57.1 (28)	58.1 (18)	47.4 (18)	52.1 (50)	
Clinical Findings %(n)					0.678
Fever	44.8 (22)	48.4 (15)	55.2 (21)	58.3 (56)	
Dyspnoea	12.3 (6)	0	2.6 (1)	9.3 (9)	
Sore throat	2 (1)	6.4 (2)	23.7 (9)	24.1 (23)	
Headache	2(1)	3.2 (1)	2.6 (1)	9.3 (9)	
Cough	12.3 (6)	18.4 (6)	7.9 (3)	4.2 (4)	
Chest pain	0	0	2.6 (1)	3.1 (3)	
Stomach ache	0	0	5.3 (2)	5.5 (5)	
Diarrhoea	8.2 (4)	6.4 (2)	2.6 (1)	4.2 (4)	
Joint pain	6.2 (3)	0	2.1 (1)	0	
Pneumonia findings	2 (1)	6.5 (2)	2.6 (1)	6.3 (6)	
Loss of taste and smell	0	0	0	4.2 (4)	

As statistical analyses, the Kruskal-Wallis test and Chi-square test were used.
* = p<0.05 was considered significant.
SD: Standard Deviation

Table 2. Parameters of patients based on age groups

Laboratory parameters and demographics	0-2 (n=49, %22.9)	3-6 (n=31, %14.5)	7-11 (n=38, %17.8)	12-18 (n=96, %44.9)	p value
(mean±SD)					
White blood cell	10.1±8.4	7.2±5.3	5±4.2	5.4±3.4	0.001*
(4.0-10.0 × 10 ⁹ /L)					
Neutrophils	3±2	3.2±2.2	3.1±1.9	4.1±2.6	0.057
(2.0-6.0× 10 ⁹ /L)					
Lymphocyte	5.3±3.7	3.3±2.1	1.7±1.3	1.5±1.2	<0.05*
(1.1-3.2 × 10 ⁹ /L)					
Monocyte x 10 ⁹ /L	1±0.8	0.5±0.3	0.3±0.3	0.5±0.3	<0.05*
Platelet x 10 ⁹ /L	387±202	287±77	302±70	263±69	<0.05*
Mean platelet volume fl	8.4±0.3	8.5±3.2	7.2±4.3	8.2±3.9	0.340
Red blood cell distribu- tion width-CV%	11.6±5.8	11.8±4.8	9.4±5.5	10.3±5.2	0.003*
CRP	214±59.8	103±22	87±28	66±14.8	0.791
D-dimer	1618±228	296±418	155±186	225±501	0.013*

As a statistical analysis, the Kruskal-Wallis test was used.
* = p<0.05 was considered significant.
SD: Standard Deviation

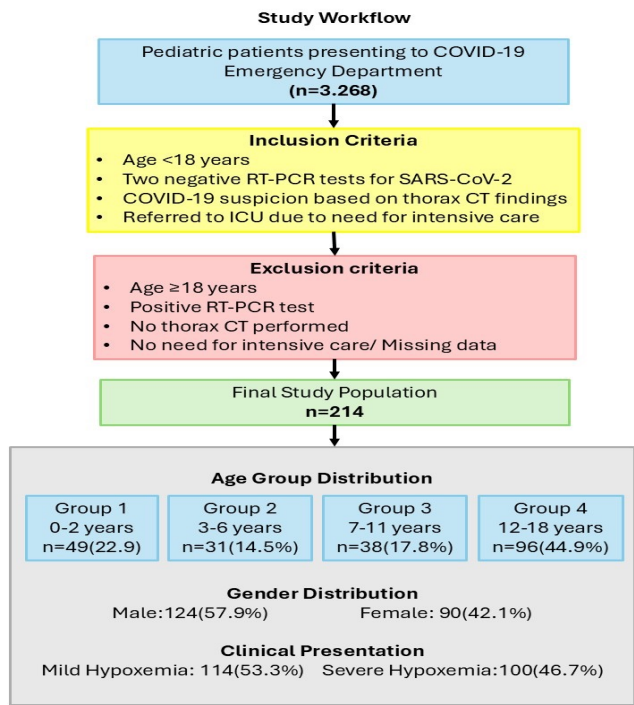


Figure 1. Study workflow

Table 3. Laboratory Parameters Based on Clinical Findings

Laboratory parameters and clinical presentation (mean±SD)	Mild Hypoxemia	Severe Hypoxemia	p value
WBC (4.0-10.0 × 10 ⁹ /L)	7.1±6.2	6.2±5.3	0.143
Neutrophils (2.0-6.0× 10 ⁹ /L)	3.6±2.4	3.5±2.5	0.740
Lymphocyte (1.1-3.2 ×10 ⁹ /L)	3±2.7	2.4±2.6	0.084
Monocyte x 10 ⁹ /L	0.6±0.4	0.6±0.5	0.466
Platelet x 10 ⁹ /L	308±142	296±100	0.472
Mean platelet volume fl	8.7±3.2	7.3±4.2	0.014*
Red blood cell distribution width-CV%	10.9±5.2	10.4±5.4	0.901
CRP	99±33	121±34	0.352
D-dimer	818±166	220±390	0.037*

As a statistical analysis Mann-Whitney U test was used.
* = p<0.05 was considered significant.
SD: Standard Deviation

the difference was not significant (p>0.05). Patients’ laboratory findings based on age groups are shown in Table 2. When patients were grouped according to mild and severe hypoxemia, D-dimer and MPV values were found to be significant at this distinction point, while other laboratory findings were not found to be statistically significant (>0.05) (Table 3). Evaluation of the correlation between clinical presentation and laboratory parameters in pediatric COVID-19 patients revealed a moderately significant negative relationship between clinical presentation and D-dimer levels and a weakly significant negative relationship between clinical presentation and MPV levels (p<0.05, rs: -0,342; p<0.05, rs: -0,175).

Discussion

During the COVID-19 pandemic, multiple studies researching the diagnostic value and utilization of laboratory parameters and clinical findings in early diagnosis and prognosis were published [15,16]. In our study, we evaluated the laboratory findings and clinical characteristics of 214 pediatric patients who received a COVID-19 diagnosis based on thoracic CT findings despite having negative RT-PCR tests and were referred due to the need for intensive care. The most important finding of our study was the significant difference in WBC, lymphocyte, platelet, and RDW levels between age groups. We also found that more than half of the patients included in the study (57.1% in the 0-2 age group, 58.1% in the 3-6 age group) presented with mild hypoxemia, and the most common symptoms were fever and cough. In their study evaluating 171 pediatric COVID-19 patients, Lu et al. reported that 15.7% of patients had mild disease and no hypoxemia [17], while Dong et al. reported this rate as 12.9% in their large series of 731 cases [18]. In a systematic review, de Souza et al. examined a total of 1124 pediatric COVID-19 cases from 38 studies and reported that 14.2% of patients had 36.3% mild disease, 46% moderate disease, 2.1% severe disease, and 1.2% critical disease [3]. The higher rate of mildly hypoxic patients in our study (between 47.4% and 57.1%) may be explained by the fact that our hospital is a regional pandemic center and that screening tests are widely used. The most common symptoms reported by de Souza et al. were fever (%47,5), cough (%41,5), and nasal symptoms (%11,2); Sediki et al. reported them as

fever (%73), cough (%54), and shortness of breath (%36) [12]. Similarly, fever, cough, shortness of breath, and dyspnoea were the most common symptoms of children hospitalised in the USA and China [19,20]. Likewise, our study found that fever and cough were the main symptoms.

Age-related changes in laboratory parameters reflect the heterogeneous nature of the pediatric population. While Guan et al. reported the rate of lymphopenia to be over %80 in their study with adult COVID-19 patients [21]. This rate is much lower in children. In a study conducted by Wang et al. on 31 pediatric patients, the lymphopenia rate was only %12,9 [22]. The significantly higher average lymphocyte count (5,3±3,7) of the 0-2 age group compared to the other age groups in our study suggests that immune response is different in young children. CRP levels being higher in the 0-2 age group (214±59,8) than in other groups, although not statistically significant, is clinically significant. Chen et al. demonstrated that elevated CRP is related to disease severity in pediatric COVID-19 patients [21]. In their meta-analysis, Lippi et al. also highlighted that procalcitonin and CRP levels increased significantly in the presence of bacterial coinfection [22]. The elevated CRP levels seen in the younger age group in our study suggest that the risk of bacterial coinfection might be higher in this age group.

Varying platelet counts in different age groups in pediatric COVID-19 patients is a remarkable finding. In their study conducted in China, Wang et al. reported that the thrombocytopenia rate was %36 in children with COVID-19 infection, and that this condition is even more pronounced in severe cases [23]. Similarly, the meta-analysis of Lippi et al. demonstrated that thrombocytopenia was observed in %57,7 of patients with severe COVID-19 infection and that this rate decreased to %31,6 in patients with mild symptoms [22]. Our study found higher platelet counts in the 0-2 age group than in the other age groups, suggesting that the inflammatory response might be different in young children. The study conducted in Wuhan by Huang et al. has similarly revealed a significant correlation between age and platelet counts [7].

The significant differences in RDW between age groups indicate that this parameter may have prognostic value in pediatric COVID-19 patients. The study by Chen et al. reported that RDW levels were associated with disease severity in COVID-19 patients and that high RDW levels might be a predictor of poor prognosis [21]. In their wide series comprising 1099 patients, Guan et al. demonstrated that hematologic parameters of COVID-19 patients changed with age and suggested that this may be associated with the age-related changes of the immune system [19]. The negative correlation between D-dimer and clinical presentation detected in our study was consistent with the findings reported by Bhuiyan et al. in their systematic review of children under the age of 5 [24]. In this study, it was shown that coagulation parameters were more stable in mildly hypoxic children, and D-dimer elevation was associated with severe hypoxemia. In our study, the significant difference in MPV value between mild and severe hypoxemic patients suggests that this parameter may be a potential marker in assessing disease severity. The study performed by Qin et al. on COVID-19 patients in Wuhan suggested that immune response dysregulation might affect thrombocyte function, and this might cause changes

in MPV levels [25]. In their meta-analysis, Mantovani et al. reported that COVID-19 infection is usually mild in children and adolescents; however, changes in laboratory parameters might be important in predicting disease severity [13]. Our findings are consistent with these data from the literature, and the high lymphocyte and platelet counts observed in the 0-2 age group in particular might be reflective of the hyper-reactivity of the immune system seen in this age group.

Strengths

One of the strengths of our study is that it is one of the rare studies researching RT-PCR-negative pediatric patients diagnosed by thoracic CT.

Limitation

Our study has its limitations. First is the single-centred and retrospective study design. Due to the retrospective design, data such as the interval between onset of symptoms and hospital admission, levels of viral load, and follow-up results are missing. Another limitation is that healthy children in the control group were not serologically evaluated for asymptomatic COVID-19 infection.

Conclusion

In conclusion, our study demonstrated that there are significant differences in laboratory parameters between age groups of patients who tested negative on RT-PCR, received a COVID-19 diagnosis based on thoracic CT findings, and were referred to the intensive care unit. Particularly, the age-related changes in WBC, lymphocyte, platelet, and RDW counts suggest that immune response changes with age in pediatric COVID-19 cases. The significant differences in D-dimer and MPV levels between mild and severe hypoxemic patients indicate that these parameters can be potential biomarkers in evaluating disease severity. These findings emphasize that age-group-specific assessment protocols must be developed and that laboratory parameters must be better utilised in clinical decision-making processes in pediatric COVID-19 patients. Future multi-centred prospective studies are required to confirm these findings and better understand prognostic factors in pediatric COVID-19.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and Human Rights Statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Funding: None

Conflict of Interest

The authors declare that there is no conflict of interest.

References

1. Zhou M, Zhang X, Qu J. Coronavirus disease 2019 (COVID-19): a clinical update. *Front Med.* 2020;14(2):126-35.
2. Xu J, Chen Y, Chen H. 2019 novel coronavirus outbreak: a quiz or final exam? *Front Med.* 2020;14(2):225-8.
3. Dong Y, Mo X, Hu Y, et al. Epidemiology of COVID-19 among children in China. *Pediatrics.* 2020;145(6):e20200702.
4. Kucirka LM, Lauer SA, Laeyendecker O. Variation in false-negative rate of reverse transcriptase polymerase chain reaction-based SARS-CoV-2 tests by time since exposure. *Ann Intern Med.* 2020;173(4):262-7.
5. Vandenberg O, Martiny D, Rochas O. Considerations for diagnostic COVID-19 tests. *Nat Rev Microbiol.* 2021;19(3):171-83.

6. Liu R, Han H, Liu F, et al. Positive rate of RT-PCR detection of SARS-CoV-2 infection in 4880 cases from one hospital in Wuhan, China, from Jan to Feb 2020. *Clin Chim Acta.* 2020;505:172-5.
7. Huang C, Wang Y, Li X, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *Lancet.* 2020;395(10223):497-506.
8. Zhou F, Yu T, Du R, et al. Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. *Lancet.* 2020;395(10229):1054-62.
9. Simon AK, Hollander GA, McMichael A. Evolution of the immune system in humans from infancy to old age. *Proc Biol Sci.* 2015;282(1821):20143085.
10. Henry BM, Benoit SW, de Oliveira MHS, et al. Laboratory abnormalities in children with mild and severe coronavirus disease 2019 (COVID-19): a pooled analysis and review. *Clin Biochem.* 2020;81:1-8.
11. Sedighi I, Fahimzad A, Pak N, et al. A multicenter retrospective study of clinical features, laboratory characteristics, and outcomes of 166 hospitalized children with coronavirus disease 2019 (COVID-19): a preliminary report from Iranian Network for Research in Viral Diseases (INRVD). *Pediatr pulmonol.* 2022;57(2):498-507.
12. CDC Covid-19 Response Team. Coronavirus disease 2019 in children-United States, February 12-April 2, 2020. *MMWR Morb Mortal Wkly Rep.* 2020;69(14):422-6.
13. Mantovani A, Rinaldi E, Zusi C. Coronavirus disease 2019 (COVID-19) in children and/or adolescents: a meta-analysis. *Pediatr Res.* 2021;89(4):733-7.
14. Mushumbamwiza H, Webster HH, Kayitesi C. Hypoxemia detection and oxygen therapy practices in neonatal and pediatric wards across seven district and referral hospitals in Rwanda. *Front Pediatr.* 2025;13:1526779.
15. Henry BM, Lippi G, Plebani M. Laboratory abnormalities in children with novel coronavirus disease 2019. *Clin Chem Lab Med.* 2020;58(7):1135-8.
16. Demir A, Gümüř H, Kazanasmaz H. An examination of the laboratory data of pediatric COVID-19 cases. *IJCMB.* 2021;1(2):33-7.
17. Lu X, Zhang L, Du H, et al. SARS-CoV-2 infection in children. *N Engl J Med.* 2020;382(17):1663-5.
18. de Souza TH, Nadal JA, Nogueira RJN. Clinical manifestations of children with COVID-19: a systematic review. *Pediatr Pulmonol.* 2020;55(8):1892-9.
19. Guan WJ, Ni ZY, Hu Y, et al. Clinical characteristics of coronavirus disease 2019 in China. *N Engl J Med.* 2020;382(18):1708-20.
20. Wang Y, Zhu F, Wang C, et al. Children hospitalized with severe COVID-19 in Wuhan. *Pediatr Infect Dis J.* 2020;39(7):e91-e94.
21. Chen N, Zhou M, Dong X, et al. Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study. *Lancet.* 2020;395(10223):507-13.
22. Lippi G, Plebani M. Procalcitonin in patients with severe coronavirus disease 2019 (COVID-19): a meta-analysis. *Clin Chim Acta.* 2020;505:190-1.
23. Wang D, Ju XL, Xie F, et al. Clinical analysis of 31 cases of 2019 novel coronavirus infection in children from six provinces (autonomous region) of northern China. *Zhonghua Er Ke Za Zhi.* 2020;58(4):269-74.
24. Bhuiyan MU, Stiboy E, Hassan MZ, et al. Epidemiology of COVID-19 infection in young children under five years: a systematic review and meta-analysis. *Vaccine.* 2021;39(4):667-77.
25. Qin C, Zhou L, Hu Z, et al. Dysregulation of immune response in patients with Coronavirus 2019 (COVID-19) in Wuhan, China. *Clin Infect Dis.* 2020;71(15):762-8.

How to cite this article:

Bensu Bulut, Murat Genç, Medine Akkan Öz, Ayşenur Gür, Ramazan Kocaaslan, Dilek Atik, Ramiz Yazıcı, Hüseyin Mutlu. Assessment of pediatric patients with negative RT-PCR and CT-based COVID-19 diagnosis referred to ICU. *Ann Clin Anal Med* 2025;16(9):663-667

This study was approved by the Ethics Committee of Dr. Abdurrahman Yurtaslan Education and Research Hospital (Date: 2021-01-13, No: 2020/07.727).